CHOOSING THE RIGHT LINER FOR YOUR APPLICATION

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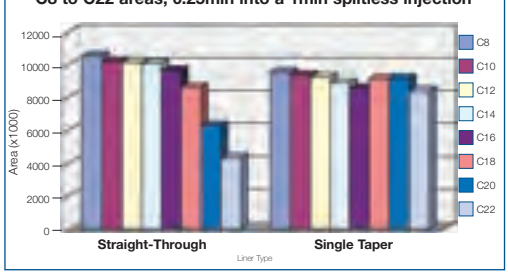
There is a vast choice of inlet liners available to today's modern chromatographer, ranging from a straight through liner to one with glass wool, baffles and laminar cups. Making the right choice can be a difficult task, but an important one that can greatly affect the sensitivity of the analysis. A liner's ability to remain inert and transfer heat effectively and efficiently depends on its design.

High Boiling Point Discrimination

In an injection port hydrocarbons all absorb energy at approximately the same rate, so it will take longer for the high boiling point compounds (>C18) to absorb the extra energy they need to vaporize. Therefore, high boiling point compounds complete their vaporization much later than volatile compounds; i.e. C8 completes vaporization before C30 etc. This is important because in a liquid injection the solvent will vaporize first along with the volatile and some semi-volatile compounds. This will take a lot of energy from the liner or base seal, but, the high boiling point compounds have not finished vaporizing and the liner or base seal is now cooler than it was before. Depending on sample size and the specific heat capacity of the solvent and injection port surface, this cooling can be significant enough to affect the rate of vaporization for high boiling point compounds. It will not affect the low boiling point compounds because they have already finished vaporizing. The result is shown in **Figure 1**.

The bar graphs in **Figure 1** show the area for C22 from the straight-through liner is only half the height of the same compound in the single tapered liner. C22 is still vaporizing in both cases but the parallel liner is less efficient at transferring energy to the sample because the vaporization has cooled the metal base seal more than glass.

FIGURE 1. Discrimination caused by the delayed vaporization of heavy hydrocarbons in the Straight-Through liner.

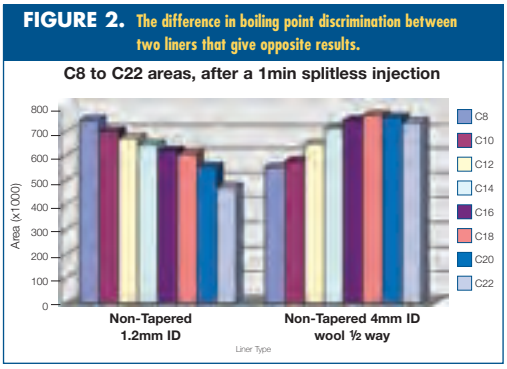


Volatile Discrimination

The loss of volatiles during vaporization usually occurs due to the expansion of the sample as it changes state. When a liquid sample is first injected it would typically have a volume of about 1µL. By the time it has been converted into a gas it could have a volume as large as 800µL. It's at this point that flow rates and liner volumes become critical in controlling the exodus of volatiles out the top of the liner. **Figure 2** shows increasing the volume of the liner does not always mean less volatile discrimination.

There are two things that should be considered when choosing a new liner to limit low boiling point discrimination:

FIGURE 2. The difference in boiling point discrimination between two liners that give opposite results.



1. The position of the vaporizing sample.
Low boiling point discrimination often occurs in liners that contain quartz wool, or some other object, which is placed in the middle of the liner. When sample hits this point, most of it is retained (depending on the liners design) and begins to vaporize. This makes it easy for the volatile components to escape via the top of the liner because they don't have far to travel. Therefore, when attempting to avoid low boiling point discrimination the liner must not have anything placed in the middle to stop the sample from reaching the bottom.

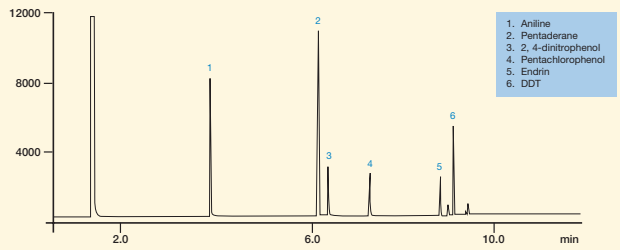
2. The velocity of the carrier gas through the liner.
To stop the gaseous sample floating upwards the carrier gas velocity can be increased as it flows down through the liner. Increasing the carrier gas velocity can be achieved without increasing the pressure or flow. If the internal diameter of the liner or part of the liner is decreased, the velocity of the carrier gas will increase making it difficult for the volatiles to escape. So choose a liner with a taper at the top or a small internal diameter rather a large ID, non-tapered liner.

The dual tapered liner is the best at increasing the sensitivity for low boiling point compounds. You can use an upside down single tapered liner and get just as good results for the low boiling point compounds but the heavier components in the sample will suffer. Small ID liners are better, but be careful when injecting volumes greater than 1µL.

Activity

Liners that contain quartz wool have been renowned for being active. Recent advances in deactivation have brought them to a standard where analyzing pesticides is now possible without significant degradation compared with other liners. Single or dual tapered liners without quartz wool are still the best for analyzing very active compounds, but the gap is closing. **Figure 3** shows the result of the new deactivation technique used on liners with wool.

FIGURE 3. Pentachlorophenol and active compounds injected into a liner with wool.



Conclusions

- To avoid high boiling point discrimination use tapered liners or Focusliners™. Do not let the sample contact the bottom of the injection port.
- To avoid low boiling point discrimination use top tapered liners. Narrow ID top tapered liners are preferable but be careful not to overload them. Do not place wool or anything else in the middle of the liner.
- The Focusliner™ is now capable of vaporizing most compounds without degradation. But for very active pesticides, tapered liners that do not contain quartz wool are still marginally better.

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